REMARKS

Applicants have read and considered the Office Action dated December 20, 2011, and the references cited therein. Claims 1 and 30 have been amended. Claims 1-3, 6-13, 15-25, 28-31, 33, 34, 36-38 and 40-42 are currently pending. Reconsideration is hereby requested.

Claims 1, 3, 9-10, 12-13, 15, 17-20, 23-25, 28-31, 37-38 and 41-42 were rejected under 35 U.S.C. §103(a) as being unpatentable over Takahashi in view of Suzuki. Applicants respectfully traverse the rejection.

As discussed in the Examiner Interview on May 16, 2012, the present invention is fundamentally different than the cited references. Moreover, claims 1 and 30 have been amended and recite features that are neither shown nor suggested by either of the references or a combination thereof. Applicants note that support for the amendments can be found at least in Figures 26 and 27 as well as paragraphs 197, 199 and 208 of the published application.

The present invention is directed to a system and method for producing stereoscopic images while compensating for movement of the image sensor assembly (e.g., as a result of human operator hand movements). An example of the system of the present invention is illustrated below Figure 1:

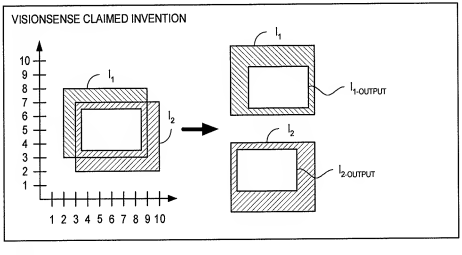

Figure 1

The system of the present invention acquires multiple alternating stereoscopic images by an image sensor. In the example set forth in Figure 1, the system acquires a first image I_1 and a second image I_2, by a sensor of 5x7 pixels. Thus, the height of I_1 is given by: 8-3=5, and the width of I_1 is given by 9-2=7, the height of I_2 is given by: 7-2=5, and the width of I_2 is given by 10-3=7.

The system of the present invention predetermines an area size for the display images (i.e., output images), which is a **constant size** for all of the display images. In the example set forth in Figure 1, the predetermined and constant area size of the display images is 3x5. The system of the claimed invention extracts from each of the acquired images I_1 and I_2, a sub-matrix which is the output image. The system of the present invention therefore employs image data from only a portion of the pixels of the sensor (e.g., 3x5 out of 5x7) for producing an output image. In particular, the present system extracts $I_{1\text{-output}}$ from the first image I_1 as the first output image, and extracts $I_{2\text{-output}}$ from the second image I_2 as the second output image. The position of the sub-matrix within the respective acquired image is determined according to relative movements of the sensor assembly between the images. Each of the sub-matrices is imaging (i.e., showing) the same area of the object, thereby compensating for movements of the sensor.

As the display images are sub-matrices of the acquired images, inevitably, the size of the display images is smaller than that of the acquired images. (See for example Figures 26-27) That is, a portion of the image sensor is "sacrificed" by omitting the image data detected thereby from the display images. Thereby, the display images of the present invention all have the same predetermined constant size, and have the same image quality as the acquired images (i.e., the same resolution).

Arguments

The monoscopic image stabilizing systems of the prior art acquire an original image and determine which portion of the image area is in common with a previous image (i.e., common image area). Such an image stabilizing system produces a new display image having the same

area as the originally acquired image from the common image area. Those systems produce the new display image either by "stretching" the determined common image area thereby deteriorating the quality of the new image with respect to the image quality of the acquired image, or by supplementing the image data of the common area with anachronistic image data from a previously acquired image. The operation of prior art image stabilizing systems is detailed further below with reference to **Suzuki**.

US Patent No. 5,522,789 (Takahashi) and US Patent No. 5,796,427 (Suzuki)

Takahashi describes a stereoscopic imaging apparatus. The system of Takahashi includes a pair of relay lens systems, an imagery optical system and a pair of imaging devices. The imagery optical system is a varifocal optical system. The system detects movements of elements within the varifocal optical imagery system and accordingly moves the image detectors. The present invention is directed to producing stereoscopic images while compensating for movements of the sensor assembly, which are perpendicular to the optical axis of the sensor assembly. Takahashi fails to discuss compensating for movements of the sensor assembly as a result of, for example, the movement and/or shaking of the hand of the operator. This is stated in section 5 (page 3) of the Office Action:

> "*Takahashi fails to disclose a movement detector for detecting movements of the sensor assembly perpendicular to the optical axis, relative to the object, and compensating for detected movements of the stereoscopic sensor assembly …*"

Therefore, Suzuki is cited to address the failures of Takahashi.

Suzuki describes a monoscopic image stabilizer as is known in the art. The operation of the image stabilizing method of the prior art, such as described by Suzuki, is illustrated herein in Figure 2:

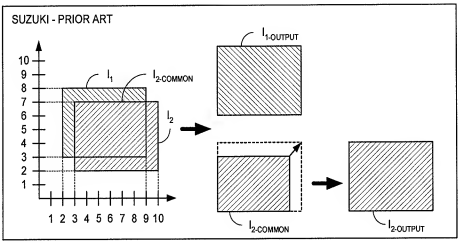

Figure 2

The prior art system acquires a consecutive pair of images I_1 and I_2, each having the same area size 5x7. In the example set forth in Figure 2, the height of I_1 is given by: 8-3=5, and the width of I_1 is given by 9-2=7. The height of I_2 is given by: 7-2=5, and the width of I_2 is given by 10-3=7. The prior art image stabilizer determines a common area $I_{2\text{-common}}$ between the first image I_1 and the second image I_2. In other words, common image area $I_{2\text{-common}}$ is the overlap between the first image I_1 and the second image I_2. Therefore, the area size of $I_{2\text{-common}}$ is derived from the movement of the image sensor between acquiring the first image and acquiring the second image. That is, the greater the movement of the image sensor between images, the smaller the common area. In the example set forth in Figure 2, the area size of $I_{2\text{-common}}$ is 4x6.

The prior art image stabilizer outputs the first image I_1 as a first output image $I_{1\text{-output}}$. The prior art image stabilizer produces a second output image $I_{2\text{-output}}$ by "stretching" $I_{2\text{-common}}$ to be of the same area size as the originally acquired images. In the example set forth in Figure 2, the prior art image stabilizer produces the second output image $I_{2\text{-output}}$ having an area size of 5x7 from $I_{2\text{-common}}$ having an area size of 4x6, thereby deteriorating the quality of the second output image $I_{2\text{-output}}$ with respect to the second image I_2. This is a fundamentally different system and method than the present invention.

Alternatively, as presented herein in Figure 3, the common image area may be smaller:

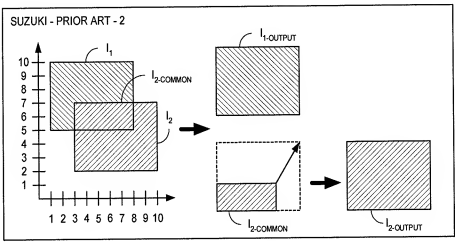

Figure 3

Suzuki states this as follows:

"*When the common area is identified, the memory controller reads only an image information representing the common area. In this case, the memory controller is set to have, for example, a long reading period so that a third image may be built by means of only this image information (a less amount of information than usual). After that, the image information is converted into a recording signal by the D/A converter.*

In the above-mentioned existing image stabilizer, there has been a problem in the amount of image information for representing an image to be recorded, although compensation of a fluctuation is performed, in case that a fluctuation of an image pickup device, namely, a fluctuation of an image happens. In other words, there has been a problem that quality of an image represented by a recording signal is deteriorated." (Emphasis added) (See Suzuki, Column 2, lines 17-32)

Suzuki aims to address the image quality deterioration of the prior art image stabilizer by supplementing the image data of the common area of the newly acquired image with anachronistic image data of the previously acquired image. The operation of the image

stabilizing method of Suzuki is illustrated herein in Figure 4:

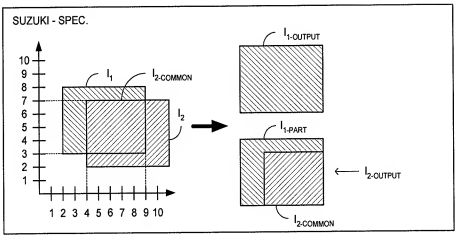

Figure 4

The Suzuki system also acquires a consecutive pair of images I_1 and I_2, each having the same area size 5x7. In the example set forth in Figure 4, the height of I_1 is given by: 8-3=5, and the width of I_1 is given by 9-2=7. The height of I_2 is given by: 7-2=5, and the width of I_2 is given by 11-4=7. The Suzuki image stabilizer determines a common area $I_{2\text{-common}}$ between the first image I_1 and the second image I_2. Therefore, common image area $I_{2\text{-common}}$ is the overlap between the first image I_1 and the second image I_2. In the example set forth in Figure 4, the area size of $I_{2\text{-common}}$ is 4x5. The common image area in Figure 4 is smaller than that of Figure 2, which means that the movement of the image sensor in the example set forth in Figure 2 is smaller than the movement in the example set forth in Figure 4.

The Suzuki image stabilizer outputs the first image I_1 as a first output image $I_{1\text{-output}}$. The Suzuki image stabilizer produces the second output image $I_{2\text{-output}}$ by supplementing $I_{2\text{-common}}$ with the portion $I_{1\text{-part}}$ of the first image I_1 which is not overlapped by the second image I_2. Both the first output image $I_{1\text{-output}}$ and the second output image $I_{2\text{-output}}$ have the same area size as the original images. The image data $I_{1\text{-part}}$ extracted from the first image I_1 is therefore outputted as a portion of the second output image $I_{2\text{-output}}$. Thereby, the second output image $I_{2\text{-output}}$ includes anachronistic image data. The Summary of Suzuki states:

"*Namely, in case that a fluctuation of the image pickup device has been detected, an newly written image information corresponding to the common area and an already stored image information excluding this common area come to be stored in the second memory. In other words, an image information, representing an image represented by combination of the latest image taken by the image pickup device and a past image taken by the image pickup device is read from the second memory.*" (Emphasis added)

Suzuki specifically describes supplementing the selected common area with additional image data from a past image such that the produced display image would have the same amount of image data (i.e., the same size) as the acquired images.

"*An apparatus for correcting image fluctuation in accordance with the invention can prevent occurrence of a problem that compensation of a fluctuation of an image causes reduction of an image information and can always give the same amount of image information as an image information produced on the basis of an image signal output from an image pickup device. Namely, the compensation is not accompanied by deterioration of quality of an image.*" (Emphasis added) (See Suzuki, Col.5, lines 14-20)

Thus, both the prior art image stabilizer and the adapted image stabilizer of Suzuki produce display images that are the same size as the acquired images. The display images of the prior art image stabilizer have a deteriorated image quality and the display images of Suzuki include anachronistic image data. Conversely, the present invention on the other hand, produces display images that are smaller than the acquired images, but which have the same image quality and which do not include anachronistic data.

"*wherein each one of said display images has a predetermined and constant area size, the area size being smaller than that of each of said detected stereoscopic images.*" (See claim 1)

Additionally, the Office Action contends that the determined common image area of the image stabilizing systems described by Suzuki discloses the sub-matrices of the present

invention. Applicants respectfully disagree. As discussed above, the present invention predetermines a constant size for each sub-matrix extracted from each acquired image. The sub-matrices are employed as display images "as is", without any modifications, and therefore have to be of the same size. Conversely, the prior art image stabilizing systems determine a common image area for a pair of consecutive images only after the images are acquired, and not in advance. The common image area of the prior art is not, and cannot be, predetermined. Furthermore, common image area between different pairs of images can differ in terms of size and does not have to be constant, as exemplified in the different common image area in Figures 2, 3 and 4. Therefore, the image stabilizing systems of the prior art do not predetermine a constant size for the sub-matrices.

A combined system of Takahashi and Suzuki would include the stereoscopic endoscope of Takahashi complemented by the image stabilizer system of Suzuki. The combined system would compensate for a movement of the image detector by identifying a common image area between consecutive images and producing from that common image area a display image. The display images of the combined system of Takahashi and Suzuki would have the area size of the acquired images and therefore would either have lower image quality or include anachronistic image data. Thus, as mentioned above, the combined system compensates for movements of the image detector in a different manner than that of the present invention, and accordingly produces different display images.

Additionally, the image stabilizing system of Suzuki operates on a single channel and would produce output images for the right channel and output images for the left channel independently. Thereby, the imaged area of the imaged object (i.e., or imaged scene) in the output images of the right channel would not correspond to that of the left channel. This lack of correspondence between the output images of the right channel and those of the left channel negates stereoscopy and thus, the combined system of Takahashi and Suzuki cannot produce stereoscopic images while compensating for movements of the sensor assembly.

For at least the above reasons, the combined system cannot be considered as disclosing or suggesting the present invention, and in particular claim 1. The arguments presented herein above with respect to a system of the present invention and with respect to independent claim 1 also apply to the method recited in independent claim 30. As independent claims 1 and 30 are new, novel and non-obvious over the combined teachings of Takahashi and Suzuki (and any other cited prior art), the dependent claims are also allowable over the prior art.

Claims 2 and 33-34 were rejected under 35 U.S.C. §103(a) as being unpatentable over Takahashi and Suzuki in view of Adelson (US 5,076,687). Adelson fails to remedy the shortcomings of the Takahashi and Suzuki combination. Therefore, Applicants assert that claims 1 and 30 patentably distinguish over the combination of Takahashi, Suzuki and Adelson. As claims 1 and 30 are allowable over the combination of Takahashi, Suzuki and Adelson, Applicants assert that claims 2 and 33-34 are allowable over the combination for at least the same reasons. Applicants therefore request that the rejection under 35 U.S.C. §103(a) be withdrawn.

Claim 36 was rejected under 35 U.S.C. §103(a) as being unpatentable over Takahashi, Suzuki and Adelson in view of Watanabe (US 5,812,187). Watanabe fails to remedy the shortcomings of the Takahashi, Suzuki and Adelson combination. Therefore, Applicants assert that claim 30 patentably distinguishes over the combination of Takahashi, Suzuki, Adelson and Watanabe. As claim 30 is allowable over the combination of Takahashi, Suzuki, Adelson and Watanabe, Applicants assert that claim 36 is allowable over the combination for at least the same reasons. Applicants therefore request that the rejection under 35 U.S.C. §103(a) be withdrawn.

Claim 40 was rejected under 35 U.S.C. §103(a) as being unpatentable over Takahashi and Suzuki in view of Watanabe. Watanabe fails to remedy the shortcomings of the Takahashi and Suzuki combination. Therefore, Applicants assert that claim 30 patentably distinguishes over the combination of Takahashi, Suzuki and Watanabe. As claim 30 is allowable over the combination of Takahashi, Suzuki and Watanabe, Applicants assert that claim 40 is allowable

over the combination for at least the same reasons. Applicants therefore request that the rejection under 35 U.S.C. §103(a) be withdrawn.

Claims 6, 8 and 11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Takahashi and Suzuki in view of Watanabe. Watanabe fails to remedy the shortcomings of the Takahashi and Suzuki combination. Therefore, Applicants assert that claims 1 and 30 patentably distinguish over the combination of Takahashi, Suzuki and Watanabe. As claims 1 and 30 are allowable over the combination of Takahashi, Suzuki and Watanabe, Applicants assert that claims 6, 8 and 11 are allowable over the combination for at least the same reasons. Applicants therefore request that the rejection under 35 U.S.C. §103(a) be withdrawn.

Claim 16 and 21-22 were rejected under 35 U.S.C. §103(a) as being unpatentable over Takahashi, Suzuki and Watanabe (US 5,812,187). Watanabe fails to remedy the shortcomings of the Takahashi and Suzuki combination. Therefore, Applicants assert that claim 1 patentably distinguishes over the combination of Takahashi, Suzuki and Watanabe. As claim 1 is allowable over the combination of Takahashi, Suzuki and Watanabe, Applicants assert that claims 16 and 21-22 are allowable over the combination for at least the same reasons. Applicants therefore request that the rejection under 35 U.S.C. §103(a) be withdrawn.

Conclusion

As demonstrated above, the present invention is neither disclosed nor suggested by any of the cited prior art references or combination thereof. A speedy and favorable action in the form of a Notice of Allowance is hereby solicited. If the Examiner feels that a telephone interview may be helpful in this matter, please contact Applicants' representative at (612) 336-4728.

Please consider this a PETITION FOR EXTENSION OF TIME for a sufficient number of months to enter these papers or any future reply, if appropriate. Please charge any additional fees or credit overpayment to Deposit Account No. 13-2725.

Respectfully submitted,

MERCHANT & GOULD P.C.

Dated: 5/21/12

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